OVERVIEW OF SURFACE WATER QUALITY ANALYSIS CONDUCTED BY CORONADO NATIONAL FOREST TO COMPLY WITH NEPA

EIS PHILOSOPHY: "...based on discussions with ADEQ on preliminary drafts of the FEIS, it was made clear to the Coronado that the responsibility and jurisdiction for assessing whether the mine meets antidegradation criteria lie with ADEQ...independent of this determination, the potential for degradation of Outstanding Arizona Waters was raised by the public as an issue of importance and therefore the Forest Service has the responsibility under NEPA to take a "hard look" at the potential for degradation." (FEIS, p. 503, 549)

"This analysis reflects the criteria developed and analyzed by the Coronado, which will differ from those used by the State of Arizona to make their determination of the ability of the proposed project to meet regulatory requirements." (FEIS, p. 547)

The EIS included the following analyses of potential impacts to downstream waters:	
BARREL CANYON 1) Potential for acid-rock drainage (FEIS, p. 468-471) 2) Potential for other contaminants (FEIS, p. 471-473) 3) Possible daylighting of tailings seepage in Barrel Canyon (FEIS, p. 380-also see Errata, 473) 4) Potential for meeting narrative SWQS (FEIS, p. 473-474) 5) Sediment yield/geomorphology changes (FEIS, p. 464-467)	**LOWER DAVIDSON CANYON** 1) Indirect effect on water quality due to streamflow depletions (FEIS, p. 540-541) 2) Indirect effect on riparian vegetation (FEIS, p. 541-545) 3) Sediment yield/geomorphology (FEIS, p. 464-467) 4) Impacts to OAW (FEIS, p. 547-555; May 2015 SIR) a) Change in perennial spring or stream flow i) If local source (FEIS, p. 534-536, 539, 544) ii) If regional source (FEIS, p. 536-538, 539, 544) b) Change in groundwater quality (FEIS, p. 379-386, 553) c) Change in surface water quality (screening analysis, FEIS, p. 548-553; SWCA 2013k) d) Ability to meet standards for i) Degradation existing water quality (FEIS, p. 553) ii) Bottom deposits (FEIS, p. 553) iii) Biological integrity of wadeable, perennial streams (FEIS, p. 553) e) Change in riparian vegetation (FEIS, p. 544) f) Change in geomorphology (FEIS, p. 464-467) g) Change in subflow from Lower Davidson to Lower Cienega (FEIS, p. 354-355)

Key documents to be aware of:	
• FEIS, December 2013 • FEIS Errata, July 2016 • Supplemental Information Report, May 2015 • Second Supplemental Information Report, July 2016	• Objections (Jan-Feb 2014), Regional Forester objection response (June 2014), and Forest Supervisor response (March 2016) • Davidson SW screening analysis – FEIS reference SWCA 2013k

ASSESSMENT OF IMPACTS TO BARREL CANYON
Analysis methodology 1) Potential for ARD: Based on 245 static and 16 kinetic tests of soil and rock acid-generation potential. 2) Potential for other contaminants: Predicted runoff water quality based on 67 SPLP tests of soil and rock, weighted by percentage of each rock type mined; SWQS based on 18 stormwater samples from Barrel watershed, Aquatic&Wildlife-Ephemeral and Partial Body Contact uses 3) Daylighting of seepage: Modeled tailings seepage water quality compared to Barrel SWQS 4) Meeting narrative SWQS: Qualitative analysis for most narrative standards; also compared predicted runoff quality to EPA secondary standards 5) Sediment yield/geomorphology: Qualitative, based on two independent studies
Results (see esp. Table 105, FEIS p. 475) 1) Potential for ARD: Limestone makes deposit largely non-acid generating. Static tests: 2 of 19 soil samples, 11 of 226 rock samples were acid generating. Kinetic tests: 1 of 16 rock types were acid generating. 2) Potential for other contaminants: Dissolved Ag (0.0025 mg/L) predicted to exceed SWQS (0.00081 mg/L). For context: Of 18 Barrel stormwater samples, 16 have too high detection limits, the remaining 2 samples exceed Barrel SWQS for dissolved Ag. SPLP from natural soil also exceeds Barrel SWQS for dissolved Ag, total Pb, and dissolved Hg. 3) Daylighting seepage (note Errata for p. 380): Concluded this scenario very unlikely (FEIS p. 380); if it were to occur, then 6 constituents exceed Barrel SWQS (Table 105, FEIS p. 475) 4) Narrative SWQS: No oil/grease, no toxicity. Aluminum (0.0205 mg/L) just over secondary standard (0.020 mg/L). For context: Aluminum found >400 mg/L in existing Barrel stormwater; 36 of 38 Barrel stormwater samples exceed the secondary standard 5) Sediment: No significant impact to geomorphology of Barrel or Davidson Canyons
Mitigating effects and limitations • All analyses peer reviewed with documentation in the project record • Waste rock segregation, req'd under APP, means only non-acid generating rock will be in contact with stormwater. By year the portion acid-generating rock varies from 9 to 16 percent. Net-neutralizing potential varies by year from +75 to >+500, with an average of +225. For context, results greater than +20 are considered acid neutralizing. • Existing stormwater in Barrel already exceeds SWQS • Monitoring intended to address geochem predictions (FEIS, p. 368-369): OA-GW-02; OA-GW-06; FS-GW-03; FS-GW-02 • Monitoring intended to address geomorph/sediment (FEIS, p. 467): FS-SR-05 • Monitoring intended to address ARD (FEIS, p. 471): OA-GW-02; OA-SW-01; FS-GW-03; FS-SR-05

ASSESSMENT OF IMPACTS TO LOWER DAVIDSON CANYON

Analysis methodology

1) Indirect effect on WQ due to streamflow depletion: Qualitative, based on streamflow loss (4.a.i)
2) Indirect effect on riparian vegetation: Qualitative, based on streamflow loss (4.a.i)
3) Sediment yield/geomorphology: Qualitative, based on two independent studies

4.a) OAW-Change in perennial flow: Weight of evidence for source of flow (Tetra Tech 2010a); modeled change in runoff (if local source); groundwater models (if regional source)

4.b) OAW-Change in GW quality: Modeled seepage water quality, comparison to AWQS

4.c) OAW-Change in SW quality: Use of "screening analysis" (FEIS p. 547-553), later revised by May 2015 SIR (p. 134) upon receipt of first Davidson stormwater samples. Major assumptions:

- "Make a "good faith, screening level" effort to predict the potential for runoff water quality to impact the Outstanding Arizona Water (OAW) reaches of Davidson Canyon and Cienega Creek..."Good faith" means that the uncertainties involved can be recognized but they should not preclude attempting the prediction, using reasonable assumptions." (SWCA 2013k, p. 2)
- Inappropriate to use SPLP as proxy for runoff quality, as was done for Barrel Canyon
- No stormwater samples in Lower Davidson in 2013; this makes it impossible to calculate numeric standards, and makes it impossible to numerically assess WQ degradation
- Mine facilities = 15% of Davidson Canyon watershed area, so we assumed that 15% of runoff = predicted waste rock/soil cover runoff, based on SPLP tests
- Assume other 85% = observed stormwater quality in Barrel Canyon

4.d.i OAW-Ability to meet standards for degradating existing WQ: Same as 4.c

4.d.ii OAW – Ability to meet standards for bottom deposits: Qualitative based on geomorphology

4.d.iii OAW – Ability to meet standards for biological integrity of wadeable, perennial streams: Qualitative based on expected reductions in flow (4.a.i)

4.e OAW – Change in riparian vegetation (see #2)

4.f OAW – Change in geomorphology (see #3)

4.g OAW - Change in subflow from Lower Davidson to Lower Cienega: Quantitative, based on 4.a.i

Results

1) Indirect effect on WQ due to streamflow depletions: "Perennial flow in lower Davidson Canyon is not occurring at present and has not occurred for several years; unlikely to be affected by changes in recharge; no impacts predicted." (FEIS, p. 548)
2) Indirect effect on riparian vegetation: "...this habitat is unlikely to experience effects, given the unlikely effects on recharge of the alluvial aquifer." (FEIS, p. 544)
3) Geomorphology: No significant impact to geomorphology of Barrel or Davidson Canyons

4.a.i) Change in perennial flow-local source: Determined to be most likely outcome based on weight-of-evidence. Reduction in average stormwater runoff of 4.3%

4.a.ii) Change in perennial flow-regional source: Two best-fit groundwater models show <0.1 feet drawdown. Ranges: Montgomery (<0.1 to 0.1); Tetra Tech (<0.1 to 0.6); Myers (Not modeled)

4.b) OAW-Change in groundwater quality: Largely not applicable given distance and lack of any transport pathway, and seepage does not exceed AWQS

ASSESSMENT OF IMPACTS TO LOWER DAVIDSON CANYON (Cont.)
4.c) OAW-Change in Davidson surface water quality using "screening analysis": • Most constituents predicted to <u>decrease</u> under postmine conditions; 5 constituents increase but less than 10%; "...two constituents may be elevated in mine runoff at levels that suggest they could present antidegradation problems: total and dissolved molybdenum, and total and dissolved sulfate." (FEIS, p. 549) • **This analysis was later negated in May 2015 SIR (p. 134)** 4.d.i) OAW-Ability to meet standards for degradation existing WQ: Same as 4.c 4.d.ii) OAW – Ability to meet standards for bottom deposits: Based on geomorphology, no effect 4.d.iii) OAW – Ability to meet standards for biological integrity of wadeable, perennial streams: 4.3% reduction in stormflow, likely no effect 4.e) OAW – Change in riparian vegetation (see #2) 4.f) OAW – Change in geomorphology (see #3) 4.g) OAW - Change in subflow from Lower Davidson to Lower Cienega: Davidson contributes 8-24% to Cienega; surface flow reduction to Davidson of 4.3%; combination results in minimal impacts to subflow

Mitigating effects and Limitations
• All analyses peer reviewed with documentation in the project record
• OAW is located ~12 miles downstream from mine, along an ephemeral drainage with little continuous alluvium and substantial transmission losses
• Uncertainty in groundwater modeling (FEIS, p. 540, see also p. 299-301)
• Lack of any stormwater samples in Lower Davidson (in 2013) made calculating numeric standards impossible; the "screening analysis" is explicitly not for quantified comparison
• First stormwater samples in Lower Davidson (in 2015), resulting in these conclusions:
  - "The screening analysis used in the FEIS...is likely not an accurate estimate of potential impacts downstream in Davidson Canyon. Barrel Canyon and Davidson Canyon stormwater quality is substantially different." (May 2015 SIR, p. 134)
  - "The new stormwater quality also illustrates the infeasibility of estimating impacts on Davidson Canyon water quality due to runoff from the mine site. Stormwater quality clearly changes greatly in the intervening 12 miles between the mine site and lower Davidson Canyon. Just as runoff in Barrel Canyon is empirically demonstrated to be dissimilar to Davidson Canyon stormwater runoff, it is reasonable to assume that mine site runoff would be equally dissimilar to Davidson Canyon, and it would be inappropriate to directly compare mine runoff that far downstream." (May 2015 SIR, p. 134)
• Monitoring intended to address GW modeling (FEIS, p. 302): FS-BR-22; FS-BR-27; FS-SSR-02
• Monitoring intended to address geochem predictions (FEIS, p. 368-369): OA-GW-02; OA-GW-06; FS-GW-03; FS-GW-02
• Monitoring intended to address stormwater modeling (FEIS, p. 403): FS-BR-22; RC-SW-01
• Monitoring intended to address geomorph/sediment (FEIS, p. 467): FS-SR-05
• Monitoring intended to address ARD (FEIS, p. 471): OA-GW-02; OA-SW-01; FS-GW-03; FS-SR-05
• Monitoring intended to address streamflow impacts (FEIS, p. 545-546): FS-BR-22; FS-BR-27; RC-SW-01
• Monitoring intended to address OAW impacts (FEIS, p. 555): FS-SR-05; RC-SW-01

COMPARISON OF KNOWN DATA FOR BARREL AND DAVIDSON

Sources: May 2015 SIR references Hudbay 2015c; Hudbay 2015e; FEIS reference SWCA 2013k

Number of days with flow events (2013-2014)

2013: Barrel = 23; Davidson = 2
2014: Barrel = 47; Davidson = 8

Peak discharge rates for flow events in common (2013-2014)

Date/Time for Barrel; Davidson Peak Flows	Barrel (cfs)	Davidson (cfs)
8/23/13 23:15; 8/24/13 00:09	93.89	37.81
9/9/13 07:00; 9/9/13 08:00	7.60	126.25
9/9/13 17:15; 9/9/13 18:00	158.66	325.83
7/9/14 18:15; 7/9/14 19:45	3.64	14.51
7/27/14 23:45; 7/28/14 01:00	80.00	34.38
8/1/14 20:00; 8/1/14 20:00	298.42	494.71
8/19/14 19:00; 8/19/14 20:00	202.12	248.16
9/8/14 13:15; 9/8/14 12:30	5.37	0.33
9/20/14 11:15; 9/20/14 11:30	58.22	457.48

Selected water quality for Barrel/Davidson stormwater* (SWCA 2013k; Hudbay 2015e)

Constituent	Barrel Canyon (mg/L)	Davidson Canyon (mg/L)	SWQS for A&W-Ephemeral (mg/L)	SWQS for PBC (mg/L)
Antimony, total	ND - 19.1	<0.0005	-	0.747
Arsenic, dissolved	ND - 0.029	<0.04	0.44	-
Arsenic, total	ND - 0.459	<0.04 – 0.046	-	0.28
Cadmium, total	ND - 0.053	<0.002	-	0.7
Cadmium, dissolved	ND	<0.002	0.08761	-
Copper, total	ND - 29	0.029 – 0.39	-	1.3
Copper, dissolved	ND – 0.152	0.0029 – 0.017	0.08588	-
Fluoride, total	ND – 0.17	<0.50	-	140
Lead, total	ND – 6.5	0.011 – 0.26	-	0.015
Lead, dissolved	ND – 0.0748	ND	0.59271	-
Mercury, total	ND – 0.00176	<0.001	-	0.28
Mercury, dissolved	ND	<0.001	0.005	-
Nickel, total	ND – 19	<0.05 – 0.054	-	28
Nickel, dissolved	ND – 4.84	<0.05	13.436	-
Selenium, total	ND – 19.1	<0.006 – 0.018	0.033	4.667
Silver, total	ND - 43.8	<0.01	-	4.667
Silver, dissolved	ND - 0.0341	ND	0.04962	-
Thallium, total	ND – 0.181	<0.0005	-	0.075
Zinc, total	ND – 17	0.052 – 0.68	-	280
Zinc, dissolved	ND	<0.04	3.599	-

* Shading indicates at least one sample above the listed SWQS; note that SWQS are listed for ephemeral uses, and calculated at a hardness of 400 mg/L

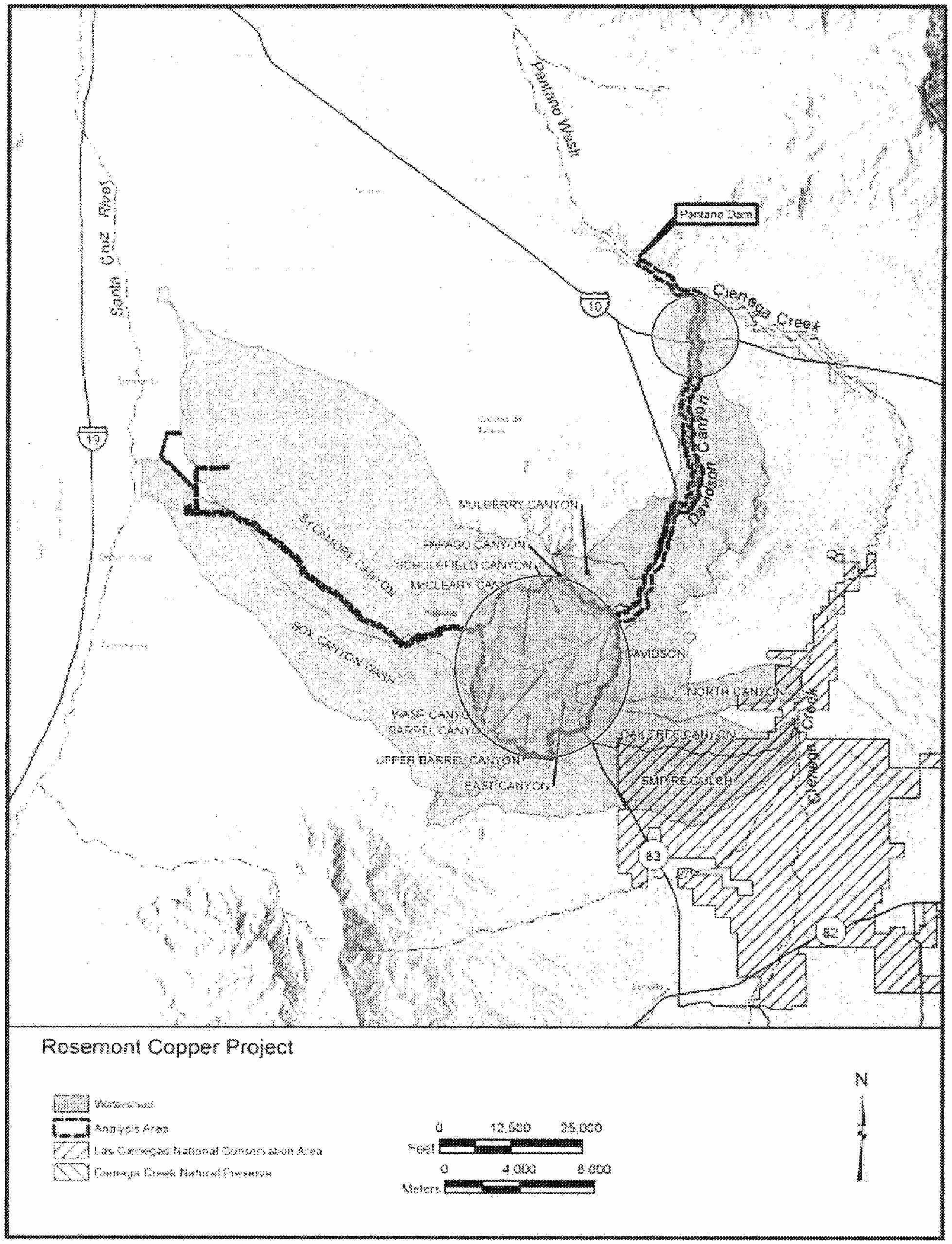

Figure 64. Analysis area for surface water quality